

Full-polarization radar remote sensing and data mining for tropical crops mapping: a successful SVM-based classification model

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In Reunion, a tropical island of 2,512 km², 700 km east of Madagascar in the Indian Ocean, constrained by a rugged relief, agricultural sectors are competing in highly fragmented agricultural land constituted by heterogeneous farming systems from corporate to small-scale farming. Policymakers, planners and institutions are in dire need of reliable and updated land use references. Actually conventional land use mapping methods are inefficient under the tropic with frequent cloud cover and loosely synchronous vegetative cycles of the crops due to a constant temperature. This study aims to provide an appropriate method for the identification and mapping of tropical crops by remote sensing. For this purpose, we assess the potential of polarimetric SAR imagery associated with machine learning algorithms. The method has been developed and tested on a study area of 25*25 km thanks to 6 RADARSAT-2 images in 2014 in full-polarization. A set of radar indicators (backscatter coefficient, bands ratios, indices, polarimetric decompositions (Freeman-Durden, Van zyl, Yamaguchi, Cloude and Pottier, Krogager), texture, etc.) was calculated from the coherency matrix. A random forest procedure allowed the selection of the most important variables on each images to reduce the dimension of the dataset and the processing time. Support Vector Machines (SVM), allowed the classification of these indicators based on a learning database created from field observations in 2013. The method shows an overall accuracy of 88% with a Kappa index of 0.82 for the identification of four major crops.